
REMARKS

The Examiner's indication that claim 6 would be allowable if rewritten in independent form has been noted with appreciation. That claim has been placed in independent form and also the Examiner's suggestion for amendment has been made.

Claim 10 has been amended to depend on claim 9. The Examiner's assumption was correct. Withdrawal of the rejection under Section 112 is, therefore, respectfully solicited.

Claims 1-5, 7, 8, 11, and 13-17 were rejected under 35 U.S.C. 103(a) over Hakotani et al. in view of Fukuta et al.; Claims 7-10 and 12 were rejected under 35 U.S.C. 103(a) over the same combination in further view of Mikeska et al.; and Claim 18 has been rejected under 35 U.S.C. 103(a) over Hakotani, Fukuta, Mikeska, and Stoller. All of these rejections are respectfully traversed.

The present invention relates to a method of manufacturing a multilayered ceramic substrate during which a reaction layer and the penetration layer are formed along an interface between a green base layer and a green constraining layer. The reaction layer is formed by a chemical reaction between the low-temperature-sinterable ceramic material and the inorganic material of the constraining layer while the penetration layer is formed by penetration of the glass component of the low-temperature-sinterable ceramic material into the green constraining layer, *i.e.*, without any chemical reaction taking place. This is described, *inter alia*, on pages 12 and 13 of the application.

The formation of both the reaction layer and the penetration layer depend on a number of factors. These include the sintering profile, *e.g.*, the rate of heating to the maximum temperature and the holding time at the maximum temperature, the identity of the particular low-temperature-sinterable ceramic material, *i.e.*, the ceramic and the glass, and the inorganic material, *e.g.*, and the type of inorganic powder and the particle

size. When correctly selected, as illustrated in the application, the desired product is achieved.

In the present invention, it is possible to have the constraining layers strongly bonded to the base layer because a reaction layer is formed between them during firing. Stresses caused by the difference in the coefficient of thermal expansion of the constraining layer and the green base layer can be efficiently removed by the fluid flow of the glass component forming a penetration layer during firing. As a result, a high degree of dimensional accuracy in the multilayered ceramic substrate can be achieved without generating undulation.

The Hakotani patent relates to a method of producing a multilayered ceramic substrate which involves the provision of two green sheets containing a low temperature firable glass-ceramic material, forming the low temperature firing sheets into a laminate and sandwiching the laminate between green sheets which contain an inorganic material which does not sinter at the firing temperature of the low temperature firing laminate, followed by firing the composite and finally removing the unsinterable inorganic material. It will be appreciated that the Hakotani patent merely describes the state of the art acknowledged in the present application. It does not, however, teach selecting the various materials and the sintering profile such that both a reaction layer and a penetration layer is formed.

The Fukuta patent has been cited to teach various materials used to form a unsinterable green sheet. Like the primary reference, it does not teach selecting the appropriate materials for the various layers and adopting a sintering profile such that a reaction layer and a penetration layer be formed.

The rejection based on Hakotani and Fukuta is based on making appropriate selections of materials and temperature profiles from the various possibilities set forth in those references. There is, however, nothing in those references which teach one skill in

the art the desirability of the formation of both a reaction layer and a penetration layer and how to make the appropriate selections so as to achieve the formation of both a reaction layer and a penetration layer.

The additional reference, Mikeska is cited to show a typical batch furnace cycle. Whether that batch profile will result in the formation of a reaction layer and penetration layer depends on the characteristics of the low-temperature-sinterable ceramic material and the inorganic material. Arbitrarily choosing that batch furnace cycle does not teach one skilled in the art how to make the appropriate selections. Therefore, this reference does not cure the basic deficiencies in the other rejections.


The further reference, Stoller, has been cited only to show a ceramic substrate joined into a mother board and is thus, not asserted to, nor does it, cure the basic deficiencies in the other combination of references.

Withdrawal of all of the § 103 rejections is respectfully solicited.

In light of all the foregoing, it is respectfully submitted that this application is now in condition for allowance and an early issuance of a Notice of Allowance is respectfully solicited.

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Respectfully submitted,

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